

Appendix E

Ecological Restoration Monitoring

This page intentionally left blank

Contents

Acronyms	E-iii
References	E-iii
E.1.0 Monitoring	E-1
E.1.1 Wetland Mitigation Monitoring	E-13
E.1.2 Species Inventory Activities	E-13
E.1.3 Activities in 2009	E-16

This page intentionally left blank

Acronyms

DOE	U.S. Department of Energy
NRRP	Natural Resource Restoration Plan
OEPA	Ohio Environmental Protection Agency
SSOD	Storm Sewer Outfall Ditch

References

42 U.S.C 103. “Comprehensive Environmental Response, Compensation, and Liability Act,” §121 et seq., *United States Code*, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499, October 1986.

DOE (U.S. Department of Energy), 2003. *2002 Consolidated Monitoring Report for Restored Areas at the Fernald Closure Project*, 20900-RP-0017, Draft, Revision B, Fluor Fernald, DOE, Fernald Area Office, Cincinnati, Ohio.

DOE (U.S. Department of Energy), 2008. *Comprehensive Legacy Management and Institutional Controls Plan*, LMS/FER/S03496, Revision 2, prepared by S.M. Stoller Corporation for DOE, Fernald Area Office, Cincinnati, Ohio, May.

OEPA (Ohio Environmental Protection Agency), 2004. *Standardized Monitoring Protocols, Data Analysis and Reporting Requirements for Mitigation Wetlands in Ohio*, v.1.0. OEPA Technical Report WET/2004-6. OEPA Division of Surface Water, Wetland Ecology Group, Columbus, Ohio.

State of Ohio, 2008. *Partial Consent Decree Resolving Ohio’s Natural Resource Damage Claim against DOE*, State of Ohio v. United States Department of Energy, et al, Civil Action No. C-1-86-0217, Judge Spiegel.

This page intentionally left blank

E.1.0 Monitoring

Ecological restoration monitoring at the Fernald Preserve in 2008 included a continuation of implementation monitoring activities and several species inventory efforts. Monitoring activities were conducted pursuant to project-specific Natural Resource Restoration Design Plans and as described in the “Integrated Environmental Monitoring Plan,” which is Attachment D of the *Comprehensive Legacy Management and Institutional Controls Plan* (DOE 2008).

Implementation monitoring activities in 2008 focused on a continuation of herbaceous cover monitoring within the former Silos area, former Waste Pits area, and portions of the former Production Area and several Non-Design areas. In addition, water quality data continued to be collected for the Phase II and Phase III wetland mitigation projects. Species inventories were conducted for fish and crayfish populations in Paddys Run and the Storm Sewer Outfall Ditch (SSOD). Data were collected for on-site bird populations as well.

Herbaceous Cover

Figure E-1 shows the restoration monitoring sub-areas that were surveyed for herbaceous cover in 2008. The herbaceous cover summary for these areas is presented in Table E-1. Sub-area data tables are presented in Tables E-1A through E-1L. The methodology established in the *2002 Consolidated Monitoring Report for Restored Areas at the Fernald Closure Project* (DOE 2003) was used to collect field data. For 2008, five random quadrats were sampled in each sub-area. A sampling and analytical program (Visual Sample Plan) was used to randomize quadrat locations within each sub-area. Sample points were field-located as global positioning system waypoints.

Acceptance criteria for herbaceous cover include 90 percent total cover and at least 50 percent native species composition. To determine this, cover class categories are assigned to each quadrat. Species richness is then determined. Quadrat findings are then averaged (for cover class) and consolidated (for species composition). Both native species composition and relative frequency of native species is calculated for each sub-area.

Results from 2008 are compared to those from 2007 in Table E-1. The findings from 2008 showed some improvement over 2007 with respect to total cover. Eleven of the twelve areas sampled had a higher average cover than in 2007. The Main Drainage Corridor, former Waste Pits, and several of the Non-Design Areas showed marked improvement.

For native species composition and relative frequency of native species, not much improvement was seen, except for the Borrow Area – West monitoring sub-area and the Rail Area. Some areas actually decreased in native composition. Since the total cover generally increased from 2007 to 2008, the decrease in native species can probably be attributed to increased presence of weedy annuals. The poor soil conditions that were previously observed, coupled with a second year of late summer/fall drought and battles with nuisance animals, continue to hinder establishment of prairie in some areas. With finalization of the Natural Resource Restoration Plan (NRRP), which is Appendix B of the *Partial Consent Decree Resolving Ohio’s Natural Resource Damage Claim against DOE* (State of Ohio 2008), the Natural Resource Trustees will evaluate the path forward for problem areas as part of a site-wide assessment of ecologically restored areas.

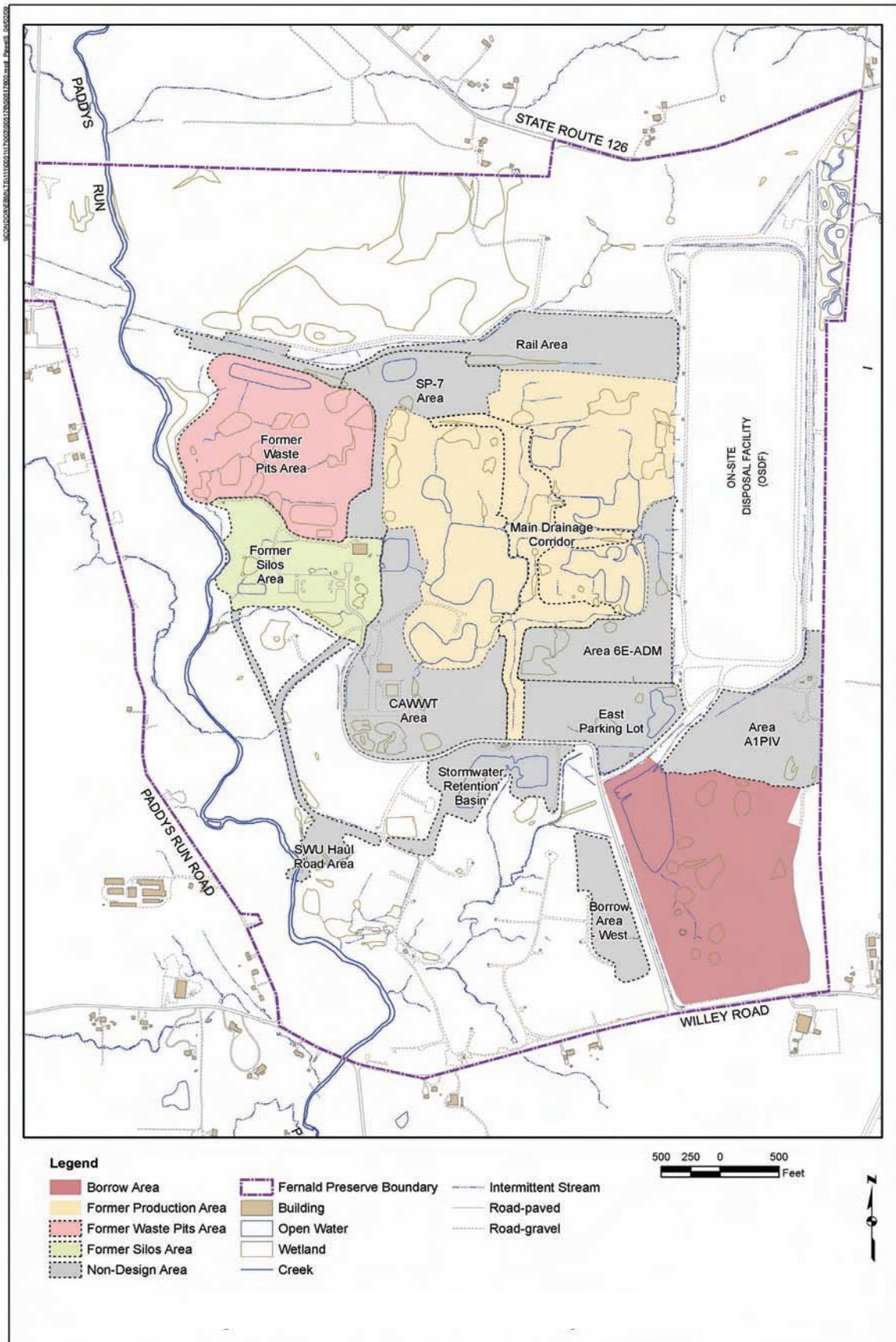


Figure E-1. Herbaceous Cover Monitoring Sub-Areas

Table E-1. Herbaceous Cover Summary

Restoration Area	Monitoring Sub-Area	Average Cover Class		Native Species Composition		Native Relative Frequency	
		2007	2008	2007	2008	2007	2008
Former Production Area	Main Drainage Corridor	2.2	4.4	53%	48%	50%	53%
Non Design Area	Stormwater Retention Basin	3.8	4.6	47%	42%	48%	40%
Non Design Area	East Parking Lot	2.6	4.4	42%	35%	38%	41%
Non Design Area	Area A1PIV	4.2	4.6	33%	44%	37%	39%
Non Design Area	Areas 6E-ADM	2.8	3.6	50%	28%	46%	36%
Non Design Area	Rail Area	2.6	2.8	29%	40%	33%	45%
Non Design Area	CAWWT Area	3.4	5.2	25%	45%	40%	42%
Non Design Area	Borrow Area - West	2.8	5.0	31%	50%	31%	44%
Non Design Area	SWU Haul Road Area	2.4	5.0	50%	44%	52%	44%
Non Design Area	SP-7 Area	4.0	4.4	30%	25%	27%	27%
Silos Area	Silos Area	3.0	2.8	18%	50%	21%	50%
Waste Pits Area	Waste Pits Area	2.2	4.0	40%	47%	59%	50%

Cover Class: 0 = 0% 1 = 2-4% 2 = 5-24% 3 = 25-49% 4 = 50-74% 5 = 75-89% 6 = 90-100%

Table E-1A. Herbaceous Cover Data Summary – Main Drainage Corridor

Total Spp.: 23
 Native Spp.: 11
 Non-Native Spp.: 12
 Percent Native: 48%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	3	0.60	8.82%
<i>Aster ericoides</i>	white heath aster	forb	2	1	0.20	2.94%
<i>Conyza canadensis</i>	horseweed	forb	0	2	0.40	5.88%
<i>Desmodium sp.</i>	tick-trefoil sp.	forb	0	1	0.20	2.94%
<i>Echinacea purpurea</i>	purple cone flower	forb	6	1	0.20	2.94%
<i>Elymus canadensis</i>	canada wild rye	grass	6	3	0.60	8.82%
<i>Eupatorium sp.</i>	boneset	forb	0	1	0.20	2.94%
<i>Monarda fistulosa</i>	bergamot	forb	3	2	0.40	5.88%
<i>Panicum virgatum</i>	switchgrass	grass	4	1	0.20	2.94%
<i>Rudbeckia hirta</i>	blackeyed susan	forb	1	2	0.40	5.88%
<i>Solidago rigida</i>	stiff goldenrod	forb	8	1	0.20	2.94%
<i>Carduus nutans</i>	nodding (musk) thistle	forb	0	2	0.40	5.88%
<i>Chenopodium album</i>	lambs quarter	forb	0	1	0.20	2.94%
<i>Cirsium arvense</i>	canada thistle	forb	0	1	0.20	2.94%
<i>Echinochloa crusgalli</i>	barnyard grass	grass	0	1	0.20	2.94%
<i>Medicago lupulina</i>	black medic	forb	0	4	0.80	11.76%
<i>Melilotus sp.</i>	sweet clover	forb	0	1	0.20	2.94%
<i>Plantago lanceolata</i>	English plantain	forb	0	1	0.20	2.94%
<i>Polygodum aviculare</i>	common knotweed	forb	0	1	0.20	2.94%
<i>Polygodum sp.</i>	knotweed sp.	forb	0	1	0.20	2.94%
<i>Portulaca oleracea</i>	common purslane	forb	0	1	0.20	2.94%
<i>Sida spinosa</i>	prickly sida	forb	0	1	0.20	2.94%
na	Regreen	grass	0	1	0.20	2.94%
Native Species:				18	3.60	52.94%
Non-Native Species:				16	3.20	47.06%

^aCC = Coefficient of Conservatism

Table E-1B. Herbaceous Cover Data Summary – Storm Water Retention Basin

Total Spp.: 26
 Native Spp.: 11
 Non-Native Spp.: 15
 Percent Native: 42%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency	
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	2	0.40	6%	
<i>Aster ericoides</i>	white heath aster	forb	2	2	0.40	6%	
<i>Biden's frondosa</i>	devil's beggar tick	forb	2	1	0.20	3%	
<i>Conyza canadensis</i>	horseweed	forb	0	2	0.40	6%	
<i>Cyperus esculentus</i>	yellow nut-sedge	sedge	0	1	0.20	3%	
<i>Echinacea purpurea</i>	purple cone flower	forb	6	1	0.20	3%	
<i>Eupatorium altissimum</i>	tall boneset	forb	0	1	0.20	3%	
<i>Panicum sp.</i>	panicum sp.	grass	0	1	0.20	3%	
<i>Panicum virgatum</i>	switch grass	grass	4	1	0.20	3%	
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	3%	
<i>Solidago canadensis</i>	tall goldenrod	forb	1	1	0.20	3%	
<i>Barbarea vulgaris</i>	yellow rocket	forb	0	1	0.20	3%	
<i>Cichorium intybus</i>	chickory	forb	0	1	0.20	3%	
<i>Daucus carota</i>	wild carrot	forb	0	1	0.20	3%	
<i>Echinochloa crusgalli</i>	barnyard grass	grass	0	1	0.20	3%	
<i>Festuca sp.</i>	fescue sp.	grass	0	3	0.60	9%	
<i>Lolium multiflorum</i>	annual rye	grass	0	1	0.20	3%	
<i>Medicago lupulina</i>	black medic	forb	0	1	0.20	3%	
<i>Melilotus sp.</i>	sweet clover	forb	0	2	0.40	6%	
<i>Plantago lanceolata</i>	English plantain	forb	0	3	0.60	9%	
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%	
<i>Polygonum sp.</i>	pink knotweed	forb	0	1	0.20	3%	
<i>Rumex crispus</i>	curly dock	forb	0	1	0.20	3%	
<i>Sonchus oleraceus</i>	common sow-thistle	forb	0	1	0.20	3%	
<i>Trifolium pratense</i>	red clover	forb	0	2	0.40	6%	
na	Regreen	grass	0	1	0.20	3%	
				Native Species:	14	2.80	40%
				Non-Native Species:	21	4.20	60%

^aCC = Coefficient of Conservatism

Table E-1C. Herbaceous Cover Data Summary – East Parking Lot

Total Spp.: 17
Native Spp.: 6
Non-Native Spp.: 11
Percent Native: 35%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	4	0.80	13%
<i>Aster pilosus</i>	awl aster	forb	1	1	0.20	3%
<i>Elymus canadensis</i>	Canada wild rye	grass	6	5	1.00	16%
<i>Ratibida pinnata</i>	gray-headed cone flower	forb	5	1	0.20	3%
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	3%
<i>Siphium perfoliatum</i>	cup plant	forb	6	1	0.20	3%
<i>Chenopodium album</i>	lamb's-quarters	forb	0	1	0.20	3%
<i>Cichorium intybus</i>	chickory	forb	0	1	0.20	3%
<i>Daucus carota</i>	wild carrot	forb	0	1	0.20	3%
<i>Echinochloa crusgalli</i>	barnyard grass	grass	0	2	0.40	6%
<i>Festuca sp.</i>	fescue sp	grass	0	2	0.40	6%
<i>Melilotus officinale</i>	sweet yellow clover	forb	0	2	0.40	6%
<i>Plantago lanceolata</i>	English plantain	forb	0	2	0.40	6%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Sonchus oleraceus</i>	common sow-thistle	forb	0	1	0.20	3%
<i>Taraxum officinale</i>	common dandelion	forb	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	5	1.00	16%
Native Species:				13	2.60	41%
Non-Native Species:				19	3.80	59%

^aCC = Coefficient of Conservatism

Table E-1D. Herbaceous Cover Data Summary – Area AIPV

Total Spp.: 25
Native Spp.: 11
Non-Native Spp.: 14
Percent Native: 44%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	3	0.60	8%
<i>Aster novae-angliae</i>	New England aster	forb	2	1	0.20	3%
<i>Aster pilosus</i>	awl aster	forb	1	1	0.20	3%
<i>Bouteloua curtipendula</i>	side-oats gamma	grass	8	1	0.20	3%
<i>Echinacea purpurea</i>	purple coneflower	forb	6	1	0.20	3%
<i>Eleocharis obtusa</i>	blunt spike rush	sedge	1	1	0.20	3%
<i>Elymus canadensis</i>	Canada wild rye	grass	6	1	0.20	3%
<i>Helianthus grosseserratus</i>	sawtooth sunflower	forb	4	1	0.20	3%
<i>Panicum virgatum</i>	switch grass	grass	4	2	0.40	6%
<i>Ratibida pinnata</i>	gray-headed coneflower	forb	5	1	0.20	3%
<i>Solidago canadensis.</i>	Canada goldenrod	forb	1	1	0.20	3%
<i>Amaranthus hybridus</i>	smooth pigweed	forb	0	2	0.40	6%
<i>Daucus carota</i>	wild carrot	forb	0	2	0.40	6%
<i>Echinochloa crusgalli</i>	barnyard grass	grass	0	3	0.60	8%
<i>Festuca sp.</i>	fescue sp.	grass	0	2	0.40	6%
<i>Medicago lupulina</i>	black medic	forb	0	1	0.20	3%
<i>Melilotus sp.</i>	sweet clover	forb	0	2	0.40	6%
<i>Plantago lanceolata</i>	English plantain	forb	0	1	0.20	3%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Polygonum persicaria</i>	lady's thumb	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	prostrate knotweed	forb	0	1	0.20	3%
<i>Rumex crispus</i>	curly dock	forb	0	1	0.20	3%
<i>Setaria glauca</i>	yellow foxtail grass	grass	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	3	0.60	8%
na	Regreen	grass	0	1	0.20	3%
Native Species:				14	2.80	39%
Non-Native Species:				22	4.40	61%

^aCC = Coefficient of Conservatism

Table E-1E. Herbaceous Cover Data Summary – Areas 6E-ADM

Total Spp.: 18
Native Spp.: 5
Non-Native Spp.: 13
Percent Native: 28%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	5	1.00	15%
<i>Bidens frondosa</i>	devil's beggars tick	forb	2	2	0.40	6%
<i>Elymus canadensis</i>	Canada wild rye	grass	6	3	0.60	9%
<i>Lespedeza capitata</i>	round-headed bush clover	forb	5	1	0.20	3%
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	3%
<i>Echinochloa crusgalli</i>	barnyard grass	grass	0	2	0.40	6%
<i>Euphorbia sp.</i>	spurge sp.	forb	0	1	0.20	3%
<i>Festuca sp.</i>	fescue sp.	grass	0	2	0.40	6%
<i>Medicago lupulina</i>	black medick	forb	0	3	0.60	9%
<i>Melilotus officinalis</i>	yellow sweet clover	forb	0	1	0.20	3%
<i>Plantago lanceolata</i>	English plantain	forb	0	2	0.40	6%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	common knotweed	forb	0	2	0.40	6%
<i>Polygonum sp.</i>	knotweed sp.	forb	0	2	0.40	6%
<i>Rumex crispus</i>	curly dock	forb	0	1	0.20	3%
<i>Thlaspi arvense</i>	field pennycress	forb	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	2	0.40	6%
na	Regreen	grass	0	1	0.20	3%
Native Species:				12	2.40	36%
Non-Native Species:				21	4.20	64%

^aCC = Coefficient of Conservatism

Table E-1F. Herbaceous Cover Data Summary – Rail Area

Total Spp.: 20
Native Spp.: 8
Non-Native Spp.: 12
Percent Native: 40%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Acer negundo</i>	box elder	tree	3	1	0.20	3%
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	3	0.60	10%
<i>Elymus canadensis</i>	canada wild rye	grass	6	3	0.60	10%
<i>Eupatorium altissimum</i>	tall boneset	forb	0	2	0.40	6%
<i>Juncus sp.</i>	rush sp.	forb	0	1	0.20	3%
<i>Phragmites australis</i>	giant reed	grass	0	1	0.20	3%
<i>Solidago canadensis</i>	Canada goldenrod	forb	1	2	0.40	6%
<i>Solidago rigida</i>	stiff goldenrod	forb	8	1	0.20	3%
<i>Amaranthus hybridus</i>	smooth pigweed	forb	0	1	0.20	3%
<i>Cichorium intybus</i>	chickory	forb	0	1	0.20	3%
<i>Cirsium ulgare</i>	bull thistle	forb	0	1	0.20	3%
<i>Daucus carota</i>	wild carrot	forb	0	1	0.20	3%
<i>Medicago lupulina</i>	black medic	forb	0	2	0.40	6%
<i>Melilotus officinale</i>	sweet yellow clover	forb	0	2	0.40	6%
<i>Plantago lanceolata</i>	English plantain	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	prostrate knotweed	forb	0	3	0.60	10%
<i>Silene latifolia</i>	white campion	forb	0	1	0.20	3%
<i>Trifolium repens</i>	white clover	forb	0	1	0.20	3%
<i>Typha angustifolia</i>	narrow leaf cattail	forb	0	1	0.20	3%
na	Regreen	grass	0	2	0.40	6%
Native Species:				14	2.80	45%
Non-Native Species:				17	3.40	55%

^aCC = Coefficient of Conservatism

Table E-1G. Herbaceous Cover Data Summary – CAWWT Area

Total Spp.: 22
 Native Spp.: 10
 Non-Native Spp.: 12
 Percent Native: 45%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Achillea millefolium</i>	yarrow	forb	1	1	0.20	3%
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	3	0.60	9%
<i>Aster pilosus</i>	awl aster	forb	1	1	0.20	3%
<i>Conyza canadensis</i>	horseweed	forb	0	2	0.40	6%
<i>Echinacea purpurea</i>	purple cone flower	forb	6	1	0.20	3%
<i>Elymus canadensis</i>	Canada wild rye	grass	6	2	0.40	6%
<i>Eupatorium altissimum</i>	tall boneset	forb	0	1	0.20	3%
<i>Panicum capillare</i>	witchgrass	grass	1	1	0.20	3%
<i>Rudbeckia hirta</i>	black eyed susan	forb	1	1	0.20	3%
<i>Solidago canadensis.</i>	Canada goldenrod	forb	1	1	0.20	3%
<i>Cirsium arvense</i>	Canada thistle	forb	0	1	0.20	3%
<i>Daucus carota</i>	wild carrot	forb	0	2	0.40	6%
<i>Festuca sp.</i>	fescue species	grass	0	1	0.20	3%
<i>Galium sp.</i>	bedstraw species	grass	0	1	0.20	3%
<i>Medicago lupulina</i>	black medic	forb	0	2	0.40	6%
<i>Melilotus officinale</i>	sweet yellow clover	forb	0	1	0.20	3%
na	Regreen	grass	0	2	0.40	6%
<i>Plantago lanceolata</i>	English plantain	forb	0	4	0.80	12%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	common knotweed	forb	0	2	0.40	6%
<i>Sonchus oleraceus</i>	sow thistle	forb	0	2	0.40	6%
<i>Trifolium pratense</i>	red clover	forb	0	1	0.20	3%
Native Species:				14	2.80	42%
Non-Native Species:				20	4.00	61%

^aCC = Coefficient of Conservatism

Table E-1H. Herbaceous Cover Data Summary – Borrow Area – West

Total Spp.: 14
 Native Spp.: 7
 Non-Native Spp.: 7
 Percent Native: 50%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	ragweed	forb	0	4	0.80	15%
<i>Aster solidagineus</i>	narrow leaf aster	forb	8	1	0.20	4%
<i>Bouteloua curtipendula</i>	side-oats gamma	grass	8	1	0.20	4%
<i>Conyza canadensis</i>	horseweed	forb	0	1	0.20	4%
<i>Elmyus canadensis</i>	canada wild rye	grass	6	2	0.40	7%
<i>Panicum virgatum</i>	switch grass	grass	4	2	0.40	7%
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	4%
<i>Daucus carota</i>	wild carrot	forb	0	2	0.40	7%
<i>Festuca sp.</i>	fescue sp.	grass	0	1	0.20	4%
<i>Plantago lanceolata</i>	English plantain	forb	0	2	0.40	7%
<i>Plantago major</i>	common plantain	forb	0	2	0.40	7%
<i>Taraxum officinale</i>	dandelion	forb	0	1	0.20	4%
<i>Trifolium pratense</i>	red clover	forb	0	5	1.00	19%
na	regreen	grass	0	2	0.40	7%
Native Species:				12	2.40	44%
Non-Native Species:				15	3.00	56%

^aCC = Coefficient of Conservatism

Table E-11. Herbaceous Cover Data Summary – SWU Haul Road Area

Total Spp.: 25
 Native Spp.: 11
 Non-Native Spp.: 14
 Percent Native: 44%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	ragweed	forb	0	4	0.80	12%
<i>Ambrosia trifida</i>	giant ragweed	forb	0	1	0.20	3%
<i>Aster lanceolatus</i>	panicked aster	forb	3	1	0.20	3%
<i>Bindens comosa</i>	swamp tickseed	forb	3	1	0.20	3%
<i>Bouteloua curtipendula</i>	side-oats gamma	grass	8	2	0.40	6%
<i>Cercis canadensis</i>	red bud	sm	3	1	0.20	3%
<i>Eupatorium serotinum</i>	late flowering boneset	forb	2	1	0.20	3%
<i>Kuhnia eupatorioides</i>	false boneset	forb	7	1	0.20	3%
<i>Lechea tenuifolia</i>	narrow leaf pinweed	forb	8	1	0.20	3%
<i>Solidago canadensis</i>	Canada goldenrod	forb	1	1	0.20	3%
<i>Toxicodendron radicans</i>	poison ivy	vine	1	1	0.20	3%
<i>Amaranthus hybridus</i>	smooth pigweed	forb	0	1	0.20	3%
<i>Cichorium intybus</i>	chickory	forb	0	1	0.20	3%
<i>Deacus carota</i>	wild carrot	forb	0	2	0.40	6%
<i>Dipsacus fullonum</i>	teasel	forb	0	3	0.60	9%
<i>Festuca sp.</i>	fescue sp.	grass	0	2	0.40	6%
<i>Lunicera maackii</i>	honey suckle	shrub	0	1	0.20	3%
<i>Melilotus sp.</i>	sweet clover	forb	0	1	0.20	3%
<i>Plantago lanceolata</i>	English plantain	forb	0	1	0.20	3%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	prostrate knotweed	forb	0	1	0.20	3%
<i>Polygonum sp.</i>	knotweed sp.	forb	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	2	0.40	6%
<i>Verbascum blattaria</i>	moth mullein	forb	0	1	0.20	3%
<i>Xanthium sp.</i>	cocklebur	forb	0	1	0.20	3%
Native Species:				15	3.00	44%
Non-Native Species:				19	3.80	56%

^aCC = Coefficient of Conservatism

Table E-1J. Herbaceous Cover Data Summary – SP-7 Area

Total Spp.: 16
 Native Spp.: 4
 Non-Native Spp.: 12
 Percent Native: 25%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	4	0.80	12%
<i>Aster pilosus</i>	awl aster	forb	1	2	0.40	6%
<i>Elymus canadensis</i>	canada wild rye	grass	6	2	0.40	6%
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	3%
<i>Amaranthus hybridus</i>	smooth pigweed	forb	0	2	0.40	6%
<i>Capsella bursa-pastoris</i>	shepards purse	forb	0	1	0.20	3%
<i>Chichorium intybus</i>	chickory	forb	0	1	0.20	3%
<i>Daucus carota</i>	wild carrot	forb	0	1	0.20	3%
<i>Dipsacus fullonum</i>	teasel	forb	0	1	0.20	3%
<i>Medico lupulina</i>	black medic	forb	0	5	1.00	15%
<i>Melilotus alba</i>	white sweet clover	forb	0	4	0.80	12%
<i>Plantago lanciatata</i>	English plantain	forb	0	5	1.00	15%
<i>Plantago major</i>	common plantain	forb	0	1	0.20	3%
<i>Polygonum aviculare</i>	common knotweed	forb	0	1	0.20	3%
<i>Taraxum officinate</i>	common dandelion	forb	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	1	0.20	3%
Native Species:				9	1.80	27%
Non-Native Species:				24	4.80	73%

^aCC = Coefficient of Conservatism

Table E-1K. Herbaceous Cover Data Summary – Silos Area

Total Spp.: 20
 Native Spp.: 10
 Non-Native Spp.: 10
 Percent Native: 50%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia aretmisiifolia</i>	common ragweed	forb	0	4	0.80	14%
<i>Andropogon gerardii</i>	big blue stem	grass	5	1	0.20	4%
<i>Aster pilosus</i>	awl aster	forb	1	2	0.40	7%
<i>Bouteloua curtipendula</i>	side-oats gamma	grass	8	1	0.20	4%
<i>Elymus canadensis</i>	canada wild rye	grass	6	1	0.20	4%
<i>Helianthus grosseserratus</i>	Sawtooth sunflower	forb	4	1	0.20	4%
<i>Heliopsis helianthoides</i>	ox-eye sunflower	forb	5	1	0.20	4%
<i>Ratibida pinnata</i>	gray-headed coneflower	forb	5	1	0.20	4%
<i>Rudbeckia hirta</i>	black-eyed susan	forb	1	1	0.20	4%
<i>Vernonia gigantea</i>	tall ironweed	forb	2	1	0.20	4%
<i>Amaranthus hybridus</i>	smooth pigweed	forb	0	1	0.20	4%
<i>Cirsium arvense</i>	canada thistle	forb	0	2	0.40	7%
<i>Daucus carota</i>	wild carrot	forb	0	1	0.20	4%
<i>Echinochiloa crusgalli</i>	barnyard grass	grass	0	1	0.20	4%
<i>Festuca sp.</i>	grass species	grass	0	4	0.80	14%
<i>Lolium multiflorum</i>	annual rye	grass	0	1	0.20	4%
<i>Medico lupulina</i>	black medic	forb	0	1	0.20	4%
<i>Melilotus sp.</i>	sweet clover	forb	0	1	0.20	4%
<i>Setaria viridis</i>	green foxtail grass	grass	0	1	0.20	4%
<i>Trifolium pratense</i>	red clover	forb	0	1	0.20	4%
Native Species:				14	2.80	50%
Non-Native Species:				14	2.80	50%

^aCC = Coefficient of Conservatism

Table E-1L. Herbaceous Cover Data Summary – Waste Pits Area

Total Spp.: 19
 Native Spp.: 9
 Non-Native Spp.: 10
 Percent Native: 47%

(non native species are in bold)

Species	Common Name	Type	CC ^a	Number of quadrats Present	Frequency (species/quadrat)	Relative Frequency
<i>Ambrosia artemisiifolia</i>	common ragweed	forb	0	3	0.60	9%
<i>Bidens frondosa</i>	devils beggar tick	forb	2	1	0.20	3%
<i>Conyza canadensis</i>	horseweed	forb	0	4	0.80	12%
<i>Echinacea pallida</i>	pale purple coneflower	forb	0	4	0.80	12%
<i>Elymus canadensis</i>	canada wild rye	grass	6	1	0.20	3%
<i>Fragaria virginiana</i>	wild strawberry	forb	1	1	0.20	3%
<i>Alopecurus sp.</i>	foxtail sp.	grass	0	1	0.20	3%
<i>Panicum sp.</i>	panigrass sp.	grass	0	1	0.20	3%
<i>Monarda fistulosa</i>	bergamot	forb	3	1	0.20	3%
<i>Bromus japonicus</i>	Japanesee brome	grass	0	1	0.20	3%
<i>Cirsium arvense</i>	Canada thistle	forb	0	1	0.20	3%
<i>Cirsium ulgare</i>	bull thistle	forb	0	1	0.20	3%
<i>Medicago lupulina</i>	black medic	forb	0	5	1.00	15%
<i>Melilotus sp.</i>	sweet clover	forb	0	1	0.20	3%
<i>Portulaca sp.</i>	milk purselane	forb	0	1	0.20	3%
<i>Taraxum officinale</i>	common dandelion	forb	0	1	0.20	3%
<i>Trifolium pratense</i>	red clover	forb	0	1	0.20	3%
na	Regreen	grass	0	4	0.80	12%
<i>Polygonum aviculare</i>	common knotweed	grass	0	1	0.20	3%
Native Species:				17	3.40	50%
Non-Native Species:				17	3.40	50%

^aCC = Coefficient of Conservatism

E.1.1 Wetland Mitigation Monitoring

Wetland mitigation monitoring in 2008 consisted of continued water quality sampling in the Phase II Wetland Mitigation Project and in the Borrow Area. This information is presented in Table E-2.

Table E-2. Wetland Mitigation Water Quality Summary

Area	Date	Temperature (celsius)	pH	Specific Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/l)	Color	Depth (ft)
Phase II, Basin 1	4/10/2008	17.3	8.58	0.315	72	6.73	partly cloudy	3.5
	6/26/2008	28.9	9.20	0.174	36	8.05	clear	3.3
	9/25/2008	20.2	8.02	0.355	12	4.92	clear	2.3
Phase II, Basin 2	4/10/2008	17.7	8.94	0.262	5	7.20	clear	2.6
	6/26/2008	28.6	8.74	0.175	11	8.11	clear	2.3
	9/25/2008	19.3	7.75	0.46	15	3.48	clear	0.7
Phase II, Basin 3	4/10/2008	16.4	9.36	0.212	49	8.09	clear	2.7
	6/26/2008	30.6	9.55	0.176	12	12.65	clear	1.6
	9/25/2008	20.6	8.13	0.359	97	4.35	cloudy	0.7
Borrow Area, Basin 3	4/10/2008	16	9.32	0.355	490	7.92	algae covered	unrecorded
	6/26/2008	29.6	9.99	0.232	35	18.70	clear, slime	unrecorded
	9/25/2008	26.1	8.54	0.409	59	10.57	cloudy	unrecorded
Borrow Area, Basin 4	4/10/2008	15.7	8.70	0.313	75	6.75	clear	2.5
	6/26/2008	30.7	9.58	0.15	46	14.80	clear, slime	2.2
	9/25/2008	28.4	7.95	0.32	126	7.04	cloudy	1.4
Borrow Area, Basin 8	4/10/2008	16.6	7.59	0.368	29	4.00	clear	unrecorded
	6/26/2008	28.4	8.32	0.215	105	9.50	clear	unrecorded
	9/25/2008	dry	dry	dry	dry	dry	dry	dry

The pH values in the Borrow Area seem to be moderating as the system matures. However, additional monitoring is needed to better understand the function of these systems. A revised wetland mitigation monitoring program is planned pursuant to the final NRRP. This revised approach is discussed in Section E.1.4.

E.1.2 Species Inventory Activities

A new effort was initiated in 2008 to inventory a variety of plant and animal species at the Fernald Preserve. This work assists with adaptive management of ecologically restored areas, adds to the local database of biological information, and provides opportunities for educational outreach.

Fish and crayfish populations in Paddys Run and the SSOD were surveyed with the help of a local high school science class. Sampling took place in September and October. Paddys Run was pooled at that time of year, but the SSOD was flowing due to the addition of groundwater for passive infiltration. Figure E-2 shows the location of sampled pools and reaches. Twenty fish species and four crayfish species were observed. Table E-3 summarizes the data collected. Of note, 40 Sloan's crayfish (*Orconectes sloanii*) were observed, including 12 in the SSOD. This is the first recording of Sloan's crayfish in the SSOD, and suggests an expanding range, potentially aided by the addition of water year-round into the SSOD.

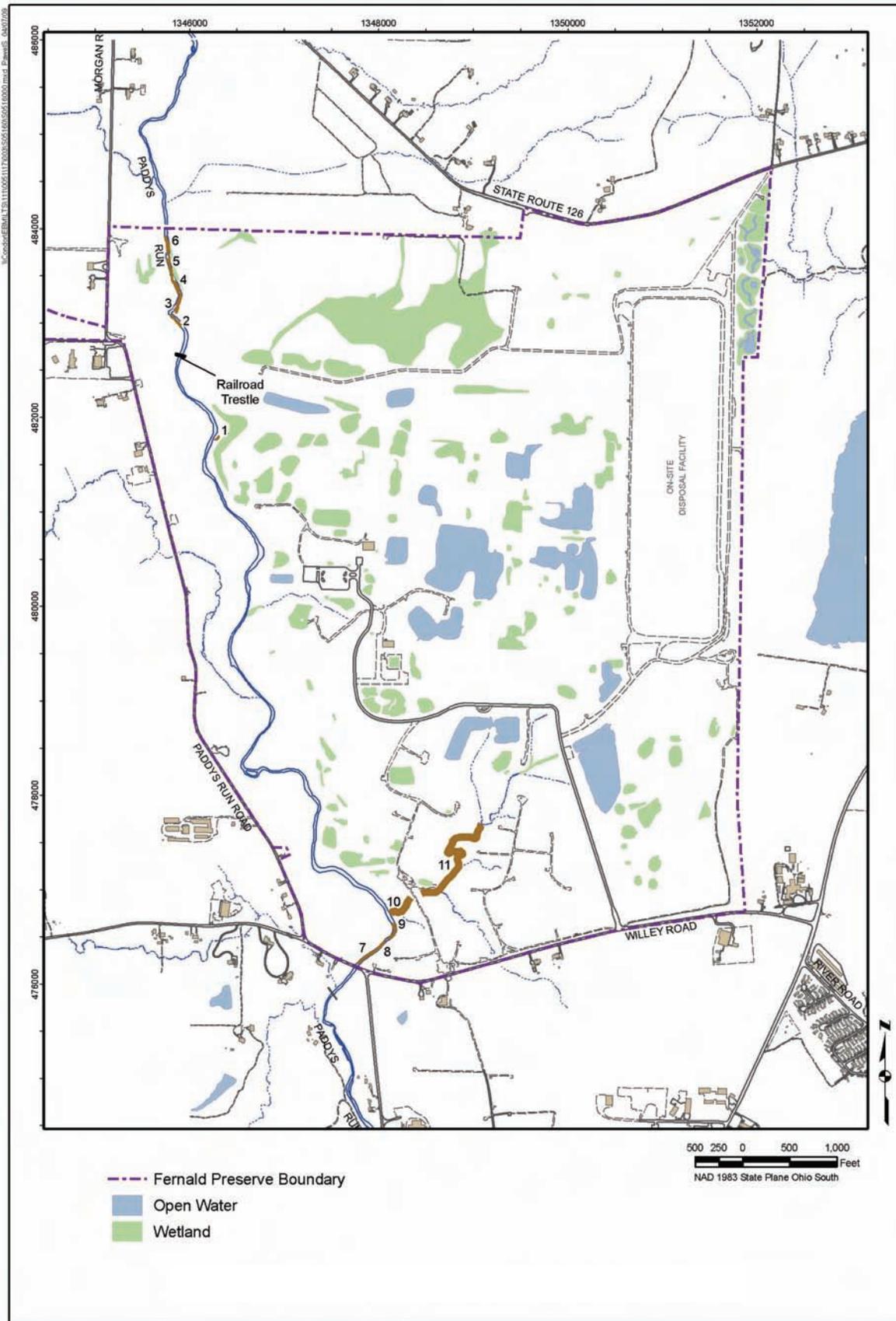


Figure E-2. Fish and Crayfish Sampling Locations

Table E-3. Paddys Run/SSOD Stream Survey Results

		Date sampled	9/23/2008	9/30/2008	9/30/2008	10/8/2008	10/8/2008	10/16/2008	10/26/2008	10/26/2008	10/26/2008	10/26/2008	10/26/2008	10/26/2008	Abundance	Relative Abundance
Scientific Name	Common Name	Pool No.	1	2	3	4	5	6	7	8	9	10	11			
Fish																
<i>Ameiurus natalis</i>	yellow bullhead catfish		1	5	0	1	2	0	0	0	0	0	0	0	9	0.8%
<i>Campostoma anomalum</i>	stoneroller minnow		42	18	7	14	22	13	19	10	39	36	50	270	24.3%	
<i>Catostomus commersoni</i>	white sucker		5	16	3	5	8	7	0	0	5	11	0	60	5.4%	
<i>Cyprinella spiloptera</i>	spotfin shiner		1	0	0	0	0	0	0	0	3	1	0	5	0.4%	
<i>Etheostoma flabellare</i>	fantail shiner		0	1	2	1	0	2	0	0	0	0	0	6	0.5%	
<i>Etheostoma nigrum</i>	Johnny darter		0	5	0	1	8	1	0	0	0	1	1	17	1.5%	
<i>Etheostoma spectabile</i>	orange throat darter		0	6	1	1	5	5	0	0	1	13	4	36	3.2%	
<i>Gambusia affinis</i>	mosquitofish		0	0	0	numerous	numerous	0	0	0	0	0	0	NA	NA	
<i>Lepomis cyanellus</i>	green sunfish		2	2	0	0	1	0	5	8	15	67	119	219	19.7%	
<i>Lepomis macrochirus</i>	bluegill		1	6	0	3	4	4	0	0	2	0	0	20	1.8%	
<i>Lepomis megalotis</i>	long eared sunfish		0	0	1	0	0	0	0	0	0	0	0	1	0.1%	
<i>Luxilus chrysocephalus</i>	striped shiner		0	0	0	1	13	1	0	0	8	2	1	26	2.3%	
<i>Lythrurus ardens</i>	rose fin shiner		0	8	1	4	2	7	4	6	10	0	0	42	3.8%	
<i>Notropis buccatus</i>	silverjaw minnow		2	16	2	2	9	0	0	0	4	5	0	40	3.6%	
<i>Phenacobius mirabilis</i>	suckermouth minnow		0	0	0	0	0	0	0	2	2	2	0	6	0.5%	
<i>Phoxinus eos</i>	southern redbellied dace		0	1	0	0	0	3	1	0	0	0	0	5	0.4%	
<i>Pimephalus notatus</i>	bluntnose minnow		20	11	7	9	9	2	33	31	28	31	19	200	18.0%	
<i>Rhinichthys atratulus</i>	blacknose dace		0	0	1	0	4	1	0	0	0	7	0	13	1.2%	
<i>Semotilus atromaculatus</i>	creek chub		1	24	4	11	10	10	3	0	3	49	21	136	12.2%	
NA	unidentified species		0	1	0	0	0	0	0	0	0	0	0	1	0.1%	
Pool Species Richness			9	14	10	13	14	12	6	5	12	12	7			
Cummulative Species Richness			9	15	17	19	19	19	19	20	20	20	20	1,112		
Crayfish																
<i>Cambarus bartonii cavatus</i>	NA		0	0	0	0	0	1	0	0	0	0	0	1	1.7%	
<i>Cambarus polychromatus</i>	NA		0	0	0	2	2	0	0	0	0	2	0	6	10.2%	
<i>Orconectes rusticus</i>	rusty crayfish		1	5	2	1	0	3	0	0	0	0	0	12	20.3%	
<i>Orconectes sloanii</i>	Sloan's crayfish		1	12	7	2	3	2	0	0	1	6	6	40	67.8%	
Pool Species Richness			2	2	2	3	2	3	0	0	1	3	1			
Cummulative Species Richness			2	2	2	3	3	4	4	4	4	4	4	59		

NA = Not Applicable

The U.S. Department of Energy (DOE) is participating in several bird data collection efforts. Information on breeding birds at the Fernald Preserve is provided to the Ohio Breeding Bird Atlas. In 2008, over 100 species of birds were recorded as probable or confirmed breeding at the site, with 85 confirmed nesting species. The large prairie areas that surround the Fernald Preserve's open water and wetlands support significant numbers of breeding grassland species, including those listed as species in decline by the National and Ohio Audubon Societies. Species observed include northern bobwhite, dickcissel, grasshopper sparrow, and eastern meadowlark. DOE expects the prairie areas to attract more species as the grasslands continue to mature. During the National Audubon Society's 2008 Christmas Bird Count, over 1,000 birds were observed at the Fernald Preserve, representing 34 species. The site routinely holds close to 1,000 waterfowl during the spring and fall migrations.

E.1.3 Activities in 2009

DOE and the Ohio Environmental Protection Agency (OEPA) signed the *Partial Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE* in November 2008 that settles a long-standing natural resource damage claim under Section 107 of the *Comprehensive Environmental Response, Compensation, and Liability Act* (42 U.S.C 103). As a result, the Fernald Natural Resource Trustees (DOE, OEPA, and the U.S. Department of Interior) have finalized the Fernald Preserve NRRP. The NRRP specifies an enhanced monitoring program for ecologically restored areas at the site. The Natural Resource Trustees will collectively evaluate restored areas via field walkdowns and review of monitoring data.

An expanded process for wetland mitigation monitoring is also included in the NRRP. The trustees will develop a plan that is based on published OEPA guidelines (OEPA 2004). This plan will be used to evaluate wetland mitigation projects at the Fernald Preserve.

Functional phase monitoring will also be resumed. Functional phase monitoring focuses more on site-wide communities (e.g. prairie, wetland, forest) than individual projects. Restored habitats are compared against baseline (pre-restoration) conditions and reference sites. The schedule for functional phase monitoring is included in the NRRP. Baseline conditions and reference sites were characterized in 2001 and 2002, and monitoring of restored areas was originally carried out from 2003 to 2005. Wetland communities will be evaluated in 2009. Portions of this effort may be combined with the wetland mitigation monitoring plan discussed above.

Species inventory work will continue in 2009, with expanded amphibian and reptile surveys planned with local subject matter experts. Formal and informal birding activities will continue. DOE will apply to the Audubon Society for designation of the Fernald Preserve as an Important Birding Area. In addition, a "BioBlitz" is scheduled for May 2009. This project is an educational outreach activity that will involve a variety of species inventory activities over a 24-hour period.